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Analysis of the organic solvent effect on the hydration and structure of human serum albumin by infrared spectroscopy

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Abstract

© 2015 by Nova Science Publishers, Inc. All rights reserved. The effect of organic solvent on the hydration and structure of human serum albumin was characterized using infrared spectroscopy in the thermodynamic water activity range from 0 to 0.98 at 25oC. Dioxane was used as a model organic solvent. This organic solvent may be considered as an informative molecular probe for analyzing the effect of hydrogen bonding and hydrophobic interactions on the hydration and structure of proteins. The obtained results show that the hydration and structure of human serum albumin depend markedly on how the protein has been hydrated - whether in the presence or in the absence of organic solvent. Two organic solvent effects on water sorption by human serum albumin were observed: 1. At low water activity (aw<0.5), the water adsorption branch obtained in the presence of organic solvent is similar to that measured in the absence of dioxane. 2. At high water activity (aw>0.5), the water sorption isotherm in the presence of dioxane lies above the corresponding isotherm for pure water. This result corresponds to the organic solvent - assisted effect on water binding by human serum albumin. Changes in the structure of human serum albumin were determined from infrared spectra by analyzing the structure of amide I band. It was found that, at low water activity, the protein-protein contacts in the dried protein largely govern its thermodynamic and structural properties. At high water activity, the protein state is determined by the protein-organic solvent and protein-water interactions. The results from the thermodynamic and structural measurements were analysed to give a unified picture of the hydration process in the absence and presence of organic solvent.